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ABSTRACT

As an alternative to traditional methodology in education research, an approach transcending the distinction between quantitative and qualitative perspectives is suggested. Emerging insights in qualitative research can be enhanced by beginning with the phenomenon of emerging order. The theory of Dissipative Structures suggests that research designs of the traditional experimental type are not appropriate environments for the emergence of spontaneous order. A research paradigm is needed to nurture far-from-equilibrium systems. The concept of autopoiesis may provide a way of conceptualizing such paradigms. Formalized as an autopoietic conversational paradigm, the conversational paradigm proposed is a social extension of the autopoiesis of the child embodied as a conversational system, in which the ongoing recursiveness of the child gives rise to an emerging order of higher coherence. (SLD)

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DESIGNS FOR EMERGING ORDER IN QUALITATIVE RESEARCH: AN ALTERNATIVE PERSPECTIVE

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INTRODUCTION

Research methodology in education has traditionally been grounded in a logic of hypothesis testing within an experimental design meeting criteria of validity epitomized by the work of Campbell & Stanley (1967). In recent years, this approach to educational research has met with penetrating critiques with the eventual emergence of a variety of new methodologies generally refered to as qualitative. In general, two kinds of perspectives have settled out of the fray: (1) those arguing that qualitative and quantitative techniques should be combined as part of a triangulating strategy, and (2) those arguing that the fundamental assumptions undergirding each approach are incompatible and therefore any combination of approaches is inconsistent as well as innappropriate. While worthwile discussion continues in this area, we think an approach which transcends the qualitative-quantitative dichotomy is worth exploring. In particular, we suggest that the phenomenon of emerging order transcends the quantitative-qualitative distinction and can serve as a significant departure point for exploring radically new thinking about educational research.

EMERGING ORDER

The process of emerging order has featured centrally in new developments in quantum physics (Bohm, 1980) thermodynamics (Prigogine, 1980), theoretical biology (Maturana & Varela, 1980), systems theory (Atlan, 1987) cybernetics (Maruyama, 1963), artificial intelligence (Hofstadter, 1980), management theory (Zeleny, 1985), counselling (Durkin, 1981), eastern philosophy (Capra, 1983), politics (Corning, 1983) and in many other domains but is conspicuous in the educational literature only by its scarcity (Sawada & Caley, 1985). This scarcity in education is surprising in the sense that emerging order is a phenomenon which is basic to spontaneity, and spontaneity would seem to be rather important in education (Sawada, 1986). Because of this scarcity we are forced to examine other areas for a discussion of emering order.

Dissipative Structure Theory

Fundamental new discoveries concerning the phenomenon of emerging order made by Ilya Prigogine (1980) have given rise to the theory of Dissipative Structures. The significance of this work was recognized in 1977 when Prigogine was awarded a Nobel Prize. Although his discoveries were made in the field of

thermodynamics Prigogine clearly saw that emerging order is a phenomenon of wider significance: it is intimately related to the spontaneity of humankind within the natural world. Prigogine & Stengers (1984), in a work appropriately titled, "Order Out Of Chaos: Man's New Dialogue With Nature" state it this way.

> This leads to a new view of matter in which matter is no longer the passive substance described in the mechanistic world view but is associated with spontaneous activity. This change is so profound that . . . we can really speak about a new dialogue of man with nature. (p. 9)

Our view is that this "new dialogue", not only of man with nature but of man with man, can form the crux of a new approach to educational research. But first, let's examine more closely the conditions under which new order configures spontaneously out of chaos.

Although order does not emerge out of chaotic situations of all kinds, it does spontaneously configure in special yet not uncommon circumstances. In general, these circumstances can be described as open systems. By this is meant a system that exchanges matter/energy with its environment.

Dissipative Structure theory tells us that of the three types of open systems: (1) those at-equilibrium within its environment, (2) those near-equilibrium within its environment, and (3) those far-from-equilibrium within its environment, only the third type leads <u>spontaneously</u> to the emergence of higher order, where higher order means a decrease in entropy. The other types may lead to order, but it will not be an order that emerges spontaneously.

When systems propel themselves through recursive feedback processes to a far-from-equilibrium state they are subject to spontaneous, dramatic reorganizations of structure. The role of <u>recursion</u> is pervasive and fundamental in the emergence of new order. It appears in the form of cross-catalytic and auto-catalytic feedback and feedforward processes which, in a compounding way, drive the system nonlinearly to a highly sensitive state far-from-equilibrium. In this state, events not normally sensed can have dramatic effects.

In a general way, then, the phenomenon of Dissipative Structures suggests that new order does indeed emerge spontaneously, but only within systems that are far-from-equilibrium with regard to their environment. This conclusion, as general as it may be, enables us to draw some new interpretations regarding traditional research designs, namely that research designs of the experimental or quasi-experimental type, seen as tightly controlled environments for both researcher and subjects, can only lead to research systems at- or near-equilibrium. It follows that little order of a spontaneous

sort can emerge in such designs. Of course, on occasion, some order of an unplanned sort may indeed spontaneously emerge <u>despite</u> the research design, but such happenings are purely serendipidous and from the perspective of the research design, are confounding. In other words, traditinal experimental designs are completely innappropriate as environments for the emergence of spontaneous order. Accordingly, what is needed is a research paradigm that nurtures far-from-equilibrium systems in which the emergence of order is not only spontaneous but can also be enhanced. The concept of autopoiesis, to which we now turn, may provide a novel yet appropriate way of conceptualizing such paradigms.

<u>Autopoiesis</u>

Dissipative Structure theory leads us to realize that spontaneity within an environment (a research design is a particular kind of environment) occurs only in systems far-from-equilibrium within the design. In qualitative educational studies, the system of interest within the design is often a single person teaching and/or learning in a classroom culture (where culture is a very special kind of environment). Realizing that the far-from-equilibrium state can be reached through recursive feedback processes that are both auto-catalytic and cross-catalytic, the specification of a person (a "living system") as a recursive system propelled by internal feedback processes would be consonant with this aspect of Dissipative Structure theory. Such a specification of a person as a recursive self-generating system is given by Maturana & Varela (1980), theoretical biologists who have generated a bold new specificaton of what makes a system a living system.

Their specification of the living is called "autopoiesis", a term coined by Maturana to account for the continual self-creation (auto-poiesis) of living systems. Maturana's concept of autopoiesis is revolutionary in its discontinuity with mainstream biological science. In referring to Maturana's work, Cohen and Wartofsky (Maturana & Varela,1980:v), the editors of the Boston Studies in the Philosophy of Science commented, "This is a bold, brilliant, provocative and puzzling work. It demands a radical shift in standpoint." At the risk of "puzzling" the reader, we present verbatim the specification of autopoiesis as given by Maturana in Maturana & Varela (1980:135). An autopoietic system is

> organized (defined as a unity) as a network of processes of production, transformation and destruction of components that produces the components which: (i) through their interactions and transformations regenerate and realize the network of processes (relations) that produced them; and (ii) constitute it as a concrete unity in the space in which they exist by specifying the topological domain of its realization as such a network.

The appearance of convolution in this definition is more than linguistic: the definition is positively circular and what is more, the circularity is necessary to express the recursively nested nature of autopoiesis: living systems are processes of production of components whose interactions as a network are the unity that is invariant over the ongoing existence of the system; this same network that is produced by the processes of production exists as a unity that itself bounds the very processes that produce the components that interact to form the network. Thus the processes of production of components are nested within a network as a unity; synchronously, the unity specifies the boundaries (topological domain) of the processes of production of the components that participate in the ongoing network (Sawada & Caley, 1986; Caley & Sawada, 1986). This definition embodies circular relations that are difficult for some educational researchers to accept because of the widespread impression that science is a straight-forward deductive enterprise. However, the recursive and nested nature of autopoiesis is antithetical to deduction and to linear thinking precisely because living systems are neither deductive nor linear; only our linguistic descriptions sometimes suffer in this way. Because of its circularity, the concept of autopoiesis provides a radical departure from established notions of the living.

Examples of autopoietic systems are cells, organs, human beings, immune systems, nervous systems, cognitive systems, and some social systems. Consideration of a community as an example of an autopoietic social system may help to clarify the concept of autopoiesis and its organization of reciprocal nesting. In particular, the relations between subcommunities and the larger community which they constitute is critical in determining the viability of the community. If a community is to maintain, transform and renew itself, these relations must be such that the "rules and regulations" that define the community as a social entity emerge as spontaneously generated relations among the components that constitute the community. Note the recursiveness of the relation between subcommunities (components) and community (network): the spontaneously generated relations among the components, once acknowledged and valued, form the boundary conditions which as a network maintain and enhance the very processes that produced the relations that formed the boundary conditions, which as a network maintain and enhance the very processes that produced the relations, and so on recursively. As this recursion continues over time, the processes that produce the boundaries (network) become nested within the boundaries; reciprocally and simultaneously the boundaries become nested within the processes that produced them. This reciprocal nesting indicates that priority cannot be placed upon either the boundaries (network) nor the processes that produced them; priority must be placed on both simultaneously.

To make this example more specific, consider a classroom as a community. If the rules and regulations that bound the classroom

are generated by the members of the class (including the teacher), then these rules and regulations are produced by the processes that enhance the "spontaneity" of class members. The relations (rules and regulations) among components (class members including the teacher) would be produced as the boundaries (network) that define, maintain and enhance the spontaneity of members. As classroom life continues, the rules and regulations as boundaries becomes nested within the spontaneity of class members; reciprocally, spontaneity becomes nested within the rules and regulations and in this sense becomes "disciplined." It is likely that such a classroom would be one in which the excitement of pursuing learning would be a community affair; reciprocally, the spirit of the class would imbue and enhance each pupil's learning. It might be said that the "classroom climate" was produced by the spontaneity of the members and that the spontaneity of the members was maintained and enhanced (disciplined) by the classroom climate. It is in this sense that classroom climate can be equated with the network of relations among components, and that the processes of production of components can be equated with spontaneity. Our point is that when both spontaneity and climate are reciprocally related as in the above example, we get a spontaneity that is enhanced yet disciplined by the very climate that it produces. Technically, we have a case of an autopoietic social system (class) bounding yet enhancing the autopoiesis of the components that constitute the class; reciprocally, we have autopoietic individuals whose relations are an actualization of the rules and regulations of the social system which they constitute.

In contrast, if the teacher were to <u>impose</u> the rules and regulations upon the class with iron hand (see note 1), or if the teacher were to allow pupils total freedom to do as they wished without regard for the larger community (school) of which the class is a subsystem, then, in either case, classroom climate would not be generated as a network defining and enhancing member spontaneity: There would be no reciprocity between climate and spontaneity. There would only be a boundary (if rules and regulations are unilaterally imposed), or undisciplined spontaneity (if the larger community (school) is totally ignored). Significant in this example are two realizations: (1) boundary conditions renew and enhance when actualized as spontaneous order; boundary conditions destroy when imposed without respect for spontaneous order, and (2) of special interest and value in education are autopoietic communities (e.g., the community of educational researchers) composed of autopoietic subcommunities (e.g., individual researchers or teams of researchers who chart their own course).

<u>Research Designs as Autopoietic Social Systems</u>

As with Zeleny (1985), we take a spontaneous social system (SSS) as a higher order living system (and therefore a system specified by autopoiesis) having autopoietic subsystems as

members. We take a research paradigm as a very specially constructed social system and therefore one that can be, but often is not, a spontaneous social system (e.g., an experimental or quasi-experimental design would not be a (SSS) because the component subsystems, the "subjects", are treated as if allopoietic (see note 1)). However, a research paradigm specified as a higher level autopoietic system generated by the components (subjects, researcher) which are themselves autopoietic would be a (SSS) and as such enhances the emergence of order from within. Such a research paradigm would be a (SSS) characterized by the very processes that specify its subsystems, i.e., autopoiesis. Recalling that far-from-equilibrium states are reached through recursive feedback processes, and realizing that autopoiesis is a process of reciprocal recursion, then a research paradigm, as a (SSS), is precisely a setting for achieving far-from-equilibrium states in which order emerges spontaneously. Stating this in another way, as a system of recursive interactions among components, a research paradigm as a (SSS) is an actualizaton of the very processes that produce the far-from-equilibrium conditions that are vital for spontaneous emergence of order as specified by Dissipative Structure theory (see Note 2).

More particularly, the researcher/subject conversational dyad often encountered in qualitative studies is a special case of a (SSS) in which the subject as well as the researcher participate as autopoietic subsystems. If they do, then the conversational dyad is an autopoietic research design with autopoietic components, and as such enhances the emergence of new order. The Reflection Methodology used in the study described below formalizes this type of conversational dyad as the autopoietic conversational paradigm.

THE AUTOPOIETIC CONVERSATIONAL PARADIGM

Building upon earlier work (Pothier & Sawada, 1983, 1984a, 1984b), a study using a rudimentary form of an autopoietic conversational paradigm was conducted in 1985 and reported in part in Sawada & Pothier (1986). The methods of this study (a study of children in a situation of sharing a birthday cake) are described here in some detail as an example of a research paradigm as an autopoietic social system with autopoietic components. We must emphasize that this study is only a first step toward actualizing the theory described above. We describe it here, not as an exemplary case, but as a way of sharing a beginning.

The study was an attempt to modify a research methodology which is traditionally referred to as clinical interview method. Piagetian clinical method would be a good example. In such methods, the Interviewer is dominantly in control and the child simply tries to do as requested. This Interviewer-Child dyad (I-C) is not a (SSS). As a beginning step toward bringing the (I-C) closer to a (SSS) we were careful to enter into the child's

setting without seeming to impose ourselves. Toward this end we visited the school before the study was formally to begin and spent several days in the classrooms essentially as teacher aides attempting to assist children in a low key manner with whatever they were working on. Our goal was to be seen by the children as interested adults who genuinely wished to listen to and to help them. We spent a week in this way.

We described the project in a letter to parents, and children who were willing to participate in the study brought back parental permission slips. In this way, more children expressed interest than we were initially prepared for. Since we wished to videotape the clinical sessions we had the equipment set up in a self-contained room where children were invited to come one at a time. We would drop by the classroom and casually chat with the child as we returned to the self-contained room. In this way we attempted to bring the (C-I) social dyad closer to a (SSS) even before the clinical interview formally began.

Theoretically, as a (SSS) the key operation in the clinical session was recursion. It was actualized through the processes of reflection and recursion in a conversational system. In particular, if after explicitly reflecting upon the way they had cut the cake in order to share it (their "partitioning" performance), children were encouraged to return to the partitioning task, the meaning such reflection might generate, could, in a recursive sense, inform further partitioning; this upon reflection, could generate more meaning that could inform further partitioning; and this in turn upon further reflection would become part of still further partitioning; and so on. This sequence of reflection upon performance would be an example of a child having a conversation with him/herself while interacting with a sharing task (a Child-Task Conversational System) and propelling himself far-from-equilibrium. Accordingly, a data acquisition plan involving a recursive cycling of reflection and performance was developed.

Phase_I The first phase consisted of what we call a "judgmental reflection session" in which the child was encouraged to select, for a given cake, a number of children for whom he/she thought it would be easy to share the cake. In this way, the tasks were not "imposed" upon the children; they were encouraged to choose on their own using their own judgment.

Phase_II The second phase followed the child's completion of each partitioning task and provided at least two opportunites for the child to reflect: firstly upon judgmental decisions, and secondly upon partitioning performance. These aspects of reflection often merged together.

Phase_III The third phase, with the use of videotape playback, involved the child in reflecting upon the entire data session (including earlier reflection sessions) as replayed on

tape.

Implementing the Three-Phase plan

All data collection sessions were video and audio taped. Children were individually interviewed in a simulated situation described as a birthday party. Both researchers were always present; one as the interviewer (participant-observer), the other as recording technician (observer-participant). Both researchers played both roles at different times with different children. At all times, however, the recording technician had the option of participating in the interviewing as well as taking notes and operating the "observational" hardware.

At the birthday party, simulated giant cookies (cakes were used in earlier studies) of various shapes made of colorful artfoam glued to a cardboard plate were to be shared with children at the party, each child at the party being represented by a miniature doll. The real child was NOT one of the children at the party. Since the party and the cakes and the children at the party (dolls) were all in miniature, the real child is an observer of the miniature party and as such assumes a role of a commentator and arranger of the party. Concomitantly, the child is also the one who partitions the cookies. Thus the child is simultaneously and actively an arranger, partitioner, and commentator. These roles interact in a synergistic manner.

A particular cookie was placed on the table. The interviewer suggested that it was supposed to be a cookie and that children at a birthday party were wishing to share it so each could get as much. It was indicated that the child might help in cutting up the cookie so that each guest could have an equal share. The child would often ask, "How many kids at the party?" The interviewer would respond, "You choose a number for which it would be easy to share the cookie" (an example of Phase I reflection). When the child indicated a number of children, the interviewer placed that number of dolls beside the cookie. The interviewer often emphasized, "Remember to cut the cookie so each child will have as much." The cuts on the cookie were indicated by laying thin sticks on the top of the cookie (Phase I performance). A supply of sticks in three different lengths were freely and conveniently available on the table to indicate cuts.

If the child completed the partitioning without difficulty he/she was often asked, "How did you know it was going to be so easy (or something to this effect)?" (This is a Phase II, judgmental reflection question.) If, on the other hand the child seemed to be experiencing difficulty in completing the "easy" partitioning, he/she was asked, "Was that as easy as you thought it would be? Can you tell me what made it difficult?" (This is an example of a Phase II, performance reflection question.) Since these reflection questions were completely contingent upon each child's judgment and/or performance, they were not uttered in

mechanical verbatim. Instead they emerged from the ongoing performance as seemed appropriate to each individual situation and sometimes were postponed to a Phase III setting. Such flexibility is a recognition of the spontaneity of each child and of the (C-I) dyad.

After approximately 10-30 minutes of interaction (i.e., after partitioning cookies in the shape of a square, an equilateral triangle, a heart, and a parallelogram), the video tape was re-wound and viewed by the child as part of a session of stimulated recall, the setting for Phase III reflection. Since the stimulated recall technique is well known (see for example, Bloom, 1946) it will not be described here. Suffice it to say that this technique provides a sensitive catalytic environment within which the child could participate reflectively by observing him/herself in action on tape and commenting on any aspect he or the researcher identified by pressing the "pause" button (Phase III reflection). The child was encouraged to press the pause button (remote-controlled) whenever he/she wished to say or do something. The researcher also paused the tape whenever a probing question seemed appropriate. In this way the autopoiesis of both child and interviewer was respected within the (C-I) social system. The task materials were freely available on the table throughout this session to encourage children to demonstrate (after pressing the pause button) their concerns (Phase III performance) as well as speak to them.

Phase III reflection, by using video tape, "simulated" the data situation, thus enabling the child to detach him/herself from the partitioning task and therefore to "perturb" (see note 2) his/her own organization while at the same time "re-living" it. In this way, Phase III reflection explicitly made the data situation self-referential through recursion. With the child controlling a pause button, entry into the "commentatory mode" of reflection was facilitated. Furthermore, provision of the task materials on the table at the time of replay allowed the child, upon pressing the pause button, to in effect "re-enter real time," and to "re-do" his partitioning in the "demonstration mode" of reflection by clarifying with the aid of the materials what he did, or might have done, or should have done, or perhaps "meant to do" the first time. All children made use of this reflective opportunity to re-enter real time. Phase III sessions were also videotaped, but these were not viewed by the child. The recursion had to stop somewhere.

THE AUTOPOIETIC NATURE OF THE PARADIGM

The conversational paradigm used in the study included four components: interviewer (researcher as participant), child, task situation, and observing technology (including a second researcher as external observer). The child, as the core subsystem within the paradigm, is denoted by (C), where the parentheses indicate

the autopoietic nature of the child. The task, in contrast, is denoted by T, where the lack of parentheses indicate an allopoietic system. While traditionally seen as an "input" from the environment, in this paradigm T is a "perturbation" (see note 2) to the child system resulting in (C-T). Here the hyphen indicates a perturbational interaction of task on child, and the parentheses indicate that the child-task system is autopoietic. (In many interview studies there is no "Task" per se. Instead there is usually a focus or a topic of interest. In such cases T could stand for Topic.) Since the interviewer is an autopoietic system as well, the task (topic) is also a perturbation within the interviewer system giving rise to (I-T). Accordingly, the conversational system evolves around the common perturbation (the task). The commonality of the task, although ostensibly the same for both child and interviewer (from the traditional point of view it is seen "objectively" as the same task) is in fact different within the two systems. It is only through the joint participation of the child-task system (C-T) and the interviewer-task system (I-T) in the larger conversational system [(C-T)-(I-T)] that the task gains any living meaning as an aspect of a larger spontaneous social system.

It is important to note that the child-task-interviewer system is symbolically denoted as [(C-T)-(I-T)] rather than (C-T-I) to explicitly indicate that the conversation is a higher order (SSS) consisting of two autopoietic subsystems of lower order each acting as a perturbation for each other. That is, in [(C-T)-(I-T)] the perturbational processes are largely conversational between two autopoietic subsystems (C-T) and (I-T). As well, the components of the conversation, (C-T) and (I-T), are perturbational in the conversational sense in that child and interviewer are, in each system, having "conversations" with the task.

The conversational dyad used as a research unit in the study, i.e., [(C-T)-(I-T)], is explicitly recursive in nature. Through conversation, the perturbational interaction (C-T) is perturbed and monitored by the perturbational interaction (I-T). Likewise, and in reciprocal (recursive) fashion, (I-T) is perturbed and monitored by (C-T). Thus, the mutually recursive relation between these two autopoietic subsystems is a reciprocity of conversation that can lead the conversational system to far-from-equilibrium states (see Caley & Sawada, 1986). As such, [(C-T)-(I-T)] is a setting for the spontaneous emergence of new order within (C) and within (I). The emergence of new order at the level of conversation, i.e., at the level of [(C-T)-(I-T)], is the purpose and the significance of the autopoietic conversational paradigm.

A level of reflection higher than [(C-T)-(I-T)] occurs when the observation technology is explicitly incorporated into the conversation by playing back the video recording of [(C-T)-(I-T)]. Several recursively connected higher level conversational systems result. For example [({C}-[(C-T)-(I-T)])-(C-T)] would denote

the child [C], while viewing the video playback of an earlier clinical interaction [(C-T)-(I-T)], pauses the playback to reflect on what transpired ([C]-[(C-T)-(I-T)]), then interacts with the task perhaps with some new insight [([C]-[(C-T)-(I-T)])-(C-T)]. This is an example of Phase III Reflection.

([I]-[([C]-[(C-T)-(I-T)])-(C-T)]), as an even higher level (SSS), would denote the larger observational system in which the interviewer, upon viewing the child interact with the task while viewing the playback, may gain a new insight into the meaning of the original conversational interaction [(C-T)-(I-T)] or of any subsystem within Phase III reflection. Furthermore, since Phase III reflection was also videotaped, the researcher could recursively interact with conversations and actions taped in Phase III. Such recursion would constitute data analysis and, within this perspective, data analysis is simply a higher level (sSS). Discussion of this point would take us beyond the intent of this paper.

In summary, perhaps the most significant aspect of the autopoietic conversational paradigm is that as a research methodology it need not be <u>imposed</u> on children. Rather, because social systems that enhance emerging order are higher level autopoietic systems composed of autopoietic subsystems (e.g., children, researchers), the conversational paradigm as such a system is a social extension of the autopoiesis of children and of researchers. As such, our wider understanding of living systems, particularly the isomorphic relations of subsystems to higher level systems (as described for example by Miller (1978) who gives a detailed explication of living systems from cell to supernational societies), is foundational to the paradigm. Our work on partitioning has been driven by the wider goal of understanding the child (C) in this multi-leveled context of <u>general living systems.</u>

The appropriateness of the autopoietic conversational paradigm is that the nature of (C) is fundamentally the same as the nature of (C-T) or [(C-T)-(I-T)] or of any supra- or subsystem generated within the conversational paradigm since all these systems are autopoietic with autopoietic subsystems (see Dawada & Pothier, 1980 for a systematic account of autopoietic suprasystems). Furthermore, the nature of (C) as the core subsystem is continuously revealed in greater detail as (C) participates in each higher level system. Mathematically, each higher level system in which (C) participates embodies transformations (perturbations) under which the identity (coherence) of (C) may be captured as an invariant under the transformations. The reorganization (compensations) created by (C) in experiencing perturbations within the higher level systems reveal the properties of the living system (C). Capturing, representing and reporting these emerging properties is the intent of the autopoietic conversational paradigm.

CLOSING REMARKS

We have briefly outlined an alternate framework within which emerging insights in qualitative research may be enhanced. The point of departure has been the integration of the spontaneity inherent in Dissipative Structures with the coherence and autonomy generated by the recursive processes of autopoiesis. As a multi-levelled (SSS), the conversational paradigm is a social extension of the autopoiesis of the child embodied as a conversational system in which the ongoing recursiveness of (C) within (SSS) gives rise to emerging order of higher coherence. Our example study is only an initial step in the development of paradigms that might enhance emerging order. We are currently conducting a study in which the structure of the paradigm is itself an actualization of the order emerging from the conversations.

NOTES

1. In the term "autopoieses" the prefix "auto" refers to self and "poiesis" refers to production. Thus autopoieses means producing self or literally self-production. In the example being discussed in the paper the teacher is laying down the rules and regulations "with iron hand." In such a situation the class is not producing itself. Rather it is being produced by an "other", namely the teacher. The term "allopoiesis" is used to describe such a system. Again the components of the term generate the meaning: allo refers to others and poiesis refers to production. Thus an allopoietic system (in contrast with an autopoietic one) is produced by others rather than being self-producing. In an allopoietic system the structure (network) is imposed upon the system; in an autopoietic system the structure is generated as an actualization of the order (coherence) emerging as a network of relations among the interacting components. (See also Caley & Sawada, 1986, especially p.273-274 for a more precise discussion.)

2. The reader may sense a contradiction between the open systems that Prigogine describes in his Dissipative Structure Theory and the closed systems specified by Maturana: How can one combine these two theories when they are based on incompatible systems? The contradiction between open and closed systems can be resolved as a problem of mixing levels of analysis. Open systems are open with respect to the exchange of energy/matter. Autopoietic systems are open in this regard as well. However, at the level of information, autopoietic systems are closed. They are closed in the sense that the organization of the system, produced as it is by the components of the system, obtains a coherence which is maintained in the face of information. Thus, if the information is sufficiently compatible with the organization to be at least sensed, then such information will act as a perturbation upon the organization, perhaps leading to a reorganization of the system.

If the information is not sufficiently compatible, it will not be sensed. In either case, the information is not "input": it either "perturbs" the system perhaps forcing it to a higher level of organization (e.g., a new level of "equilibration" to use Piaget's term) or it is not sensed at all (see Varela, 1979 for a more detailed presentation of this distinction).

REFERENCES

Atlan, H. (1987). Uncommon finalities. In W. I. Thompson *Gaia: A way of knowing* (pp. 110-128). Great Barrington, MA: Lindisfarne Press.

Bloom, B. (1946). *The study of conscious thought processes by the method of stimulated recall.* Unpublished doctoral dissertation, University of Chicago.

Bohm, D. (1980). *Wholeness and the implicate order.* London: Routledge & Kegan Paul.

Caley, M. T. & Sawada, D. (1986). Recursive complementarity. *Cybernetica,* 29, 263-275.

Campbell, D. T. & Stanley, J. C. (1967). *Experimental and quasi-experimental designs for research.* Chicago: Rand McNally.

Capra, F. (1983). *The Turning Point: Science, Society, and the Rising Culture.* New York: Bantam.

Corning, P. A. (1983). *The synergism hypothesis* New York: McGraw-Hill.

Durkin, J. E. (Ed.). (1981). *Living Groups: Group psychotherapy and general systems theory.* New York: Brunnel Mazel.

Hofstadter, D. R. (1980). *Godel, Escher, Bach: The eternal golden braid.* New York: Vintage Books.

Maruyama, M. (1963). The second cybernetics: Deviation-amplifying mutual causal processes. *American scientist,* 51, 164-179.

Maruyama, M. (1978). Heterogenistics and morphogenetics: Toward a new concept of the scientific. *Theory and society,* 5, 75-96.

Maruyama, M. (1980). Mindscapes and science theories. *Current anthropology,* 21, 589-608.

Maturana, H. & Varela, F. J. (1980). *Autopoiesis*

and cognition. Dordrecht, Holland: Reidel.

Miller, J. G. (1978). Living systems. New York: McGraw-Hill.

Pask, G. (1975). Conversation, cognition and learning. New York: Elsevier.

Pothier, Y. & Sawada, D. (1983). Partitioning: The emergence of rational number ideas in young children. Journal for research in mathematics education, 14, 307-318.

Pothier, Y. & Sawada, D. (1984a). Children's judgments concerning "easy" partitioning tasks as related to a theory of partitioning. (ERIC No. ED 245 836).

Pothier, Y. & Sawada, D. (1984b). Some geometrical aspects of early fraction experiences. Recherches en didactique des mathematiques. 5, 215-228.

Prigogine, I. (1980). From being to becoming: Time and complexity in physical sciences. San Francisco: W. H. Freeman.

Prigogine, I. & Stengers, I. (1984). Order out of chaos: Man's new dialogue with nature. New York: Basic Books.

Sawada, D. & Caley, M. T. (1985). Dissipative structures: New metaphors for becoming in education. Educational researcher, 14, 3, 13-19.

Sawada, D. & Caley, M. T. (1986). Cybernetics, autonomy and Education. A paper presented at the Annual Meeting of the Society for General Systems Research. Philadelphia.

Sawada, D. & Pothier, Y. (1986). Toward a self-referential theory of partitioning: Methodological considerations. A paper presented at the Annual Meeting of the American Educational Research Association. San Francisco.

Varela, F. (1979). Principles of biological autonomy. New York: North Holland.

Zeleny, M. (1985). Spontaneous social orders. International journal of general systems, 11, 117-131.